

We Claim:

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1. A programmable blood processing system coupled to a blood separation device comprising a cassette containing several preformed, pneumatically actuated pump stations, several preformed fluid flow paths, and several preformed, pneumatically actuated valves in the fluid flow paths, and  
5 a programmable pneumatic actuator to hold the cassette and selectively apply pneumatic force to the valves and pump stations in response to a control program to place any selected fluid flow path in flow communication with any selected pump station.
  - 10 2. A system according to claim 1, wherein the pneumatic actuator selectively applies both positive pressure and negative pressure to the valves and pump stations.
  3. A system according to claim 1, wherein the pneumatic actuator selectively applies positive pressure to close the valves and negative pressure to open the valves.
  4. A system according to claim 1, wherein the pneumatic actuator selectively applies positive pressure to expel fluid from the pump stations and negative pressure to draw fluid into the pump stations.
  5. A system according to claim 1, wherein at least one of the pump stations includes first and second pump chambers operating in tandem in response to the application of pneumatic force.
  6. A programmable blood processing system coupled to a blood separation device comprising a cassette containing several preformed, pneumatically actuated pump stations, several preformed fluid flow paths, and several preformed, pneumatically actuated valves in the fluid flow paths,

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a programmable pneumatic actuator to hold the cassette and selectively apply pneumatic force to the valves and pump stations in response to a control program to place any selected fluid flow path in flow communication with any selected pump station, and

15 a controller having a first selectable control program to direct the pneumatic actuator to apply pneumatic force to the valves and pump stations to perform a first blood separation procedure, the controller also having a second selectable control program to direct the pneumatic actuator to apply pneumatic force to the valves and pump stations to perform a second blood separation procedure different than the first blood separation procedure, whereby 20 the preformed pump stations, preformed fluid flow paths, and preformed valves in the cassette can accommodate different blood processing procedures.

7. A system according to claim 6  
wherein the pneumatic actuator selectively applies both positive pressure and negative pressure to the valves and pump stations.

8. A system according to claim 6  
wherein the pneumatic actuator selectively applies positive pressure to close the valves and negative pressure to open the valves.

9. A system according to claim 6  
wherein the pneumatic actuator selectively applies positive pressure to expel fluid from the pump stations and negative pressure to draw fluid into the pump stations.

5 10. A system according to claim 6  
wherein at least one of the pump stations includes first and second pump chambers operating in tandem in response to the application of pneumatic force.

11. A programmable blood processing system  
coupled to a blood separation device comprising

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5 *A.J.* a cassette containing several preformed, pneumatically actuated pump stations, several preformed fluid flow paths, and several preformed, pneumatically actuated valves in the fluid flow paths, and

10 a programmable pneumatic actuator to hold the cassette and selectively apply pneumatic force to the valves and pump stations in response to a control program to direct fluid flow through any selected pump station in either a forward direction between two valves, or a reverse direction between two valves, or an in-out direction through a single valve.

12. A system according to claim 11 wherein the pneumatic actuator selectively applies both positive pressure and negative pressure to the valves and pump stations.

13. A system according to claim 11 wherein the pneumatic actuator selectively applies positive pressure to close the valves and negative pressure to open the valves.

5 14. A system according to claim 11 wherein the pneumatic actuator selectively applies positive pressure to expel fluid from the pump stations and negative pressure to draw fluid into the pump stations.

15. A system according to claim 11 wherein at least one of the pump stations includes first and second pump chambers operating in tandem in response to the application of pneumatic force.

SN 16. A programmable blood processing system  
A/ coupled to a blood separation device comprising  
a cassette containing several preformed, pneumatically actuated pump stations, several preformed fluid flow paths, and several preformed, pneumatically actuated valves in the fluid flow paths, and  
a programmable pneumatic actuator to hold the

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cassette and selectively apply pneumatic force to the valves and pump stations in response to a control program to simultaneously place two of the pump stations in flow communication with the blood separation device while simultaneously placing a third pump station in flow communication with a venipuncture.

17. A system according to claim 16  
wherein a first pump station is placed in communication with an inlet of the blood separation device while a second pump station is placed in simultaneous communication with an outlet of the blood separation device.

18. A system according to claim 16 wherein the programmable pneumatic actuator selectively applies pneumatic force to the valves and third pump station to direct fluid flow through the third pump station in either a direction away from the venipuncture or a direction toward the venipuncture.

19. A system according to claim 16,  
wherein the programmable pneumatic actuator  
selectively applies pneumatic force to the valves and pump  
stations to direct fluid flow through any selected pump  
station in either a forward direction between two valves, or  
a reverse direction between two valves, or an in-out  
direction through a single valve.

20. A system according to claim 16 further including a controller having a first selectable control program to direct the pneumatic actuator to apply pneumatic force to the valves and pump stations to perform a first blood separation procedure, the controller having a second selectable control program to direct the pneumatic actuator to apply pneumatic force to the valves and pump stations to perform a second blood separation procedure different than the first blood separation procedure, whereby the preformed pump stations, preformed fluid flow paths, and preformed valves in the cassette can accommodate different

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blood processing procedures.

21. A system according to claim 16  
wherein the pneumatic actuator selectively applies both positive pressure and negative pressure to the valves and pump stations.

22. A system according to claim 16  
wherein the pneumatic actuator selectively applies positive pressure to close the valves and negative pressure to open the valves.

23. A system according to claim 16  
wherein the pneumatic actuator selectively applies positive pressure to expel fluid from the pump stations and negative pressure to draw fluid into the pump stations.

5 24. A system according to claim 16  
wherein at least one of the pump stations includes first and second pump chambers operating in tandem in response to the application of pneumatic force.

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25. A programmable blood processing system coupled to a blood separation device comprising a cassette containing several preformed, pneumatically actuated pump stations, several preformed fluid flow paths, and several preformed, pneumatically actuated valves in the fluid flow paths, and

10 a programmable pneumatic actuator to hold the cassette and selectively apply pneumatic force to the valves and pump stations in response to a control program to place a first pump station in communication with an inlet of the blood separation device to supply blood to the separation device for separation into components, a second pump station in communication with an outlet of the blood separation device to withdraw a blood component from the blood separation device, and a third pump station in communication with a venipuncture to supply and return blood to a donor.

15 26. A system according to claim 25

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wherein the programmable pneumatic actuator selectively applies pneumatic force to the valves and first and second pump stations to simultaneously supply blood to and withdraw blood from the separation device.

27. A system according to claim 25

wherein the programmable pneumatic actuator selectively applies pneumatic force to the valves and pump stations to supply blood to or withdraw blood from the separation device while blood is supplied from or returned to the donor.

28. A system according to claim 25

wherein the programmable pneumatic actuator selectively applies pneumatic force to the valves and pump stations to place a fourth pump station in communication with a source of anticoagulant for mixing with blood.

29. A system according to claim 25

wherein the programmable pneumatic actuator selectively applies pneumatic force to the valves and third pump station to place the third pump station in communication with a source of fluid for mixing with blood.

30. A system according to claim 25

further including a controller having a first selectable control program to direct the pneumatic actuator to apply pneumatic force to the valves and pump stations to perform a first blood separation procedure, the controller having a second selectable control program to direct the pneumatic actuator to apply pneumatic force to the valves and pump stations to perform a second blood separation procedure different than the first blood separation procedure, whereby the preformed pump stations, preformed fluid flow paths, and preformed valves in the cassette can accommodate different blood processing procedures.

31. A system according to claim 25

wherein the pneumatic actuator selectively applies both positive pressure and negative pressure to the

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valves and pump stations.

32. A system according to claim 25 wherein the pneumatic actuator selectively applies positive pressure to close the valves and negative pressure to open the valves.

33. A system according to claim 25 wherein the pneumatic actuator selectively applies positive pressure to expel fluid from the pump stations and negative pressure to draw fluid into the pump stations.

5 34. A system according to claim 25 wherein at least one of the pump stations includes first and second pump chambers operating in tandem in response to the application of pneumatic force.

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steps of  
5 providing a cassette containing several preformed, pneumatically actuated pump stations, several preformed fluid flow paths, and several preformed, pneumatically actuated valves in the fluid flow paths, and placing the cassette in association with a pneumatic actuator to selectively apply pneumatic force to the valves and pump stations,

10 providing a first selectable control program to operate the pneumatic actuator to perform a first desired blood processing procedure using the cassette including conveying blood through a separation device for separation into a first component part, at least a portion of which is collected, and

15 providing a second selectable control program to operate the pneumatic actuator to perform a second desired blood processing procedure using the cassette including conveying blood through a separation device for separation into a second component part, at least a portion of which is collected.

36. A blood processing method according to  
claim 35

wherein the first component part includes red  
blood cells.

37. A blood processing method according to  
claim 35

wherein the second component part includes  
plasma.

38. A blood processing method according to  
claim 35

further including the step of providing a third  
selectable control program to operate the pneumatic actuator  
to perform a third desired blood processing procedure using  
the cassette including conveying blood through a separation  
device for separation into first and second component parts,  
at least a portion of which are collected.